

BEST AVAILABLE COPY

PCT

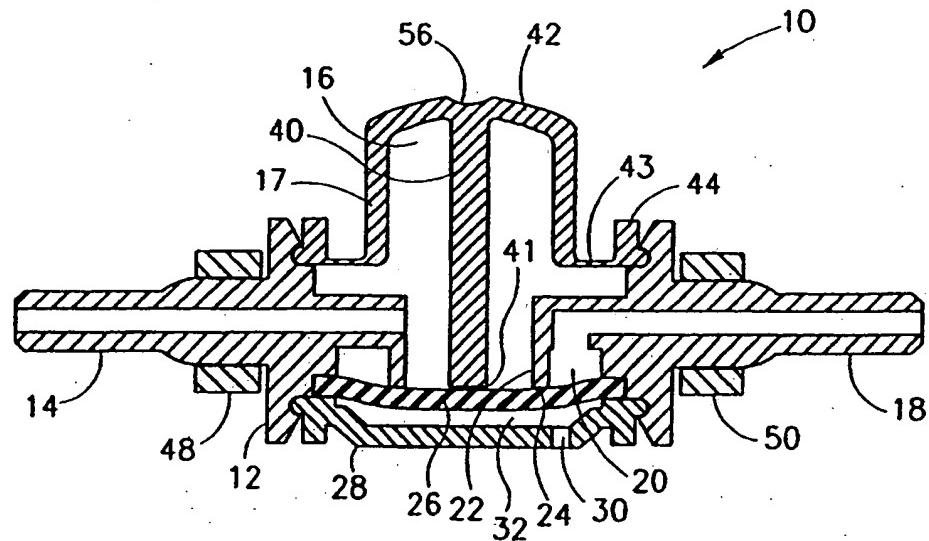
WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : A61M 5/168, 39/22		A1	(11) International Publication Number: WO 00/37128
			(43) International Publication Date: 29 June 2000 (29.06.00)
(21) International Application Number:	PCT/IL99/00688	(81) Designated States:	AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
(22) International Filing Date:	16 December 1999 (16.12.99)	Published	With international search report.
(30) Priority Data:	127681 22 December 1998 (22.12.98) IL		
(71) Applicants (for all designated States except US):	ARAN ENGINEERING DEVELOPMENT LTD. [IL/IL]; P.O. Box 3067, Industrial park, 38900 Caesaria (IL). CAESARIA MEDICAL ELECTRONIC LTD. [IL/IL]; P.O. Box 4294, 38900 Caesaria (IL).		
(72) Inventors; and			
(75) Inventors/Applicants (for US only):	SHFARAM, Adi [IL/IL]; Shalom Alechem Street 2, 46703 Herzeliya (IL). BARAK, Zvi [IL/IL]; P.O. Box 4294, 38900 Caesaria (IL).		
(74) Agent:	REINHOLD COHN AND PARTNERS; P.O. Box 4060, 61040 Tel Aviv (IL).		

(54) Title: FLUID FLOW CONTROL VALVE



(57) Abstract

A fluid valve comprising a housing fitted with a first port being in flow communication with a first chamber, and a second port being in fluid communication with a second chamber coaxial with the first chamber. A fluid flow path extends between the chambers and a resilient membrane tensioned over the fluid flow path and over the first chamber and the second chamber so as to close the fluid flow path. The membrane has one face exposed to atmospheric pressure. The arrangement being such that when differential pressure across the membrane exceeds a predetermined pressure threshold the membrane flexes and opens the fluid flow path allowing fluid flow between the first chamber and the second chamber.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Larvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		

FLUID FLOW CONTROL VALVE

FIELD OF THE INVENTION

The present invention is in the field of fluid flow control valves, such as for use in medical fluid administration sets, etc.

5 BACKGROUND OF THE INVENTION

It is often required to provide a fluid control valve which operates within a specific pressure range. An example for such an instance is a set for administrating medical liquids to a patient, in which a container holding the liquid is supported by a stand at a height of typically about two meters or at times being provided within a pressuring device.

It is required to ensure that liquid contained within the container freely flows in a direction towards the patient and to prevent flow in an opposite direction, i.e. in a direction from the patient.

15 A variety of liquid flow control valves are known. Typical prior art flow valves are fitted on a fluid supply line and comprise a membrane sealingly engaging a closure between an upstream portion and a downstream portion of the supply line, which upon exposure to a predetermined pressure, the membrane deforms to open a flow path towards the upstream portion.

20 - By another example, the membrane comprises one or more apertures such as pre-pierced or pre-slotted apertures which in a non deformed position, the apertures are closed. However, upon deformation of the membrane under a predetermined pressure, the apertures open and fluid flow is enabled through the supply line.

Typically fluid flow control valves are unidirectional, i.e. permitting flow from an inlet port towards an outlet port but not *vice versa*. In cases where the valve is Bi-directional, then the pressure required to initiate flow is typically identical in both directions of operation.

- 5 Other types of flow valves are of complex structure and are provided with mechanical components such as springs, gaskets and pistons and thus render the valve complexity and of essentially high costs.

- Many of the heretofore known control valves are not provided with priming means and where such means are provided, there are no arrangements for
10 retaining the priming means in their priming position, but rather it is required to manually keep the priming means depressed.

It is an object of the present invention to provide an improved fluid flow control valve in which the above referred to drawbacks are essentially reduced or overcome.

15

SUMMARY OF THE INVENTION

According to a preferred aspect of the present invention there is provided a fluid valve comprising a housing fitted with a first port being in flow communication with a first chamber, and a second port being in fluid communication with a second chamber coaxial with the first chamber; a fluid flow path extending between the chambers; a resilient membrane tensioned over the fluid flow path and over the first chamber and the second chamber so as to close the fluid flow path, said membrane having one face thereof exposed to atmospheric pressure; the arrangement being such that when differential pressure across the membrane exceeds a predetermined pressure threshold the membrane flexes and opens the fluid flow path allowing fluid flow between the first chamber and the second chamber.

According to a preferred embodiment of the present invention, the valve is formed with a priming member for manually displacing the membrane to disengage from the fluid flow path and open it. Preferably, the priming member is

a stem projecting from a wall of the first chamber connected to other portions of the first chamber via a flexible zone, whereby displacing the wall towards the membrane entails displacing the membrane and priming of the valve.

Still preferably, the priming member is biased to disengage from the 5 membrane. By one of its designs, the flexible zone of the first chamber is resilient and is biased to resume its original shape.

By still a preferred embodiment of the present invention, the valve further comprises a retention member for retaining the priming member in its displaced position, thereby keeping the fluid flow path open. By one application of this 10 preferred embodiment, there is further provided a locking arrangement for arresting the retention member in a position in which the fluid flow path is kept open.

Desirably, the first port and the second port coaxially extend from the housing along an axis normal to the axis of the chambers, and the retention 15 member is a bridge-like element comprising a retaining portion for engaging the wall portion, and two arms, each engaged with one of the first or second port, respectively, and being rotatable about the port's axis.

By a preferred design of the valve in accordance with the present invention, the first chamber is a well-like enclosure having a bottom wall portion 20 communicating with other portions of the first chamber via a flexible zone. A top, rimmed edge separates between the first and second chambers and forms the fluid flow path and over which the membrane is tensioned.

Still preferably, the housing further comprises a venting cover positioned in close proximity to the flexible membrane whereby in its flexed state the 25 membrane bears against the venting cover. The venting cover is fitted with one or more venting apertures. Among its tasks, the venting cover also secures the membrane to the housing along a peripheral edge thereof.

In order to avoid blocking of the one or more venting apertures upon flexing of the membrane, the one or more apertures are preferably formed at 30 peripheral portions of the venting cover.

It will be appreciated that the valve according to the present invention may be a Bi-directional valve and the cross-sectional area of the membrane over the first chamber may be similar or different to the cross-sectional area of the membrane over the second chamber, whereby the differential pressure required to open the flow path in one direction may be different than the differential pressure required to open the flow path in the other direction.

BRIEF DESCRIPTION OF THE DRAWING

In order to understand the invention and to see how it may be carried out in practice, a preferred embodiment will now be described, by way of a non-limiting example only, with reference to the accompanying drawings in which:

Fig. 1 is a longitudinal cross-section of a valve according to the present invention, the valve in its closed position;

Fig. 2 is an isometric view of the valve seen in Fig. 1;

Fig. 3 is a longitudinal cross-section of the valve according to the present invention, the valve in its open position;

Fig. 4 is a longitudinal cross-section of the valve according to the present invention in a priming position, with a priming retainer in its locked position; and

Fig. 5 is an isometric view of the valve in the position seen in Fig. 4.

DETAILED DESCRIPTION OF A SPECIFIC EMBODIMENT

Attention is first directed to Figs. 1 and 2 of the drawings illustrating a valve generally designated **10** comprising a cylindrical housing **12** formed with a first, inlet port **14** extending into a first, inlet chamber **16**, the latter being coaxial with the housing **12**. First chamber **16** is formed by a well-like member **17** snapingly engaging the housing **12**.

A second, outlet port **18** is coaxial with the inlet port **14** and extends into a second, outlet chamber **20**, which in fact is in the shape of an annulus which is

coaxial with the first chamber 16 and which have a common separating wall 22 terminating at a rimmed annular edge 24 which defines a fluid flow path between the first and second chambers as will hereinafter be explained.

A resilient membrane 26 is securely attached to the housing 12 by a venting cover 28 snapingly fitted to the housing 12, where the membrane 26 sealingly bears against the rimmed annular edge 24, thus sealing the first and second chambers 16 and 20, respectively, and the flow path 24 extending between the chambers.

As can be seen in Fig. 1, the venting cover 28 is fitted with a venting aperture 30 at a peripheral portion of the cover, for the reason to become apparent hereinafter. It will further be noted that the vented cover 28 is in close proximity to the membrane 26, though leaving a clearance 32 therebetween, wherein atmospheric pressure exists.

A stem-like priming member 40 extends from a bottom wall portion 42 of the first chamber 16, said stem-member 40 extending almost towards a bottom surface of the membrane 26 leaving a clearance between its upper end 41 and membrane 26. Well-like member 17 has a resilient, deformable portion 43 communicating with snapping wall portion 44. In the position shown in Fig. 1 the resilient portion is in its non-deformed position.

A retention member 46 (best seen in Fig. 2) has a bridge-like shape with two annular portions 48 and 50 rotatably engaged over inlet port 14 and outlet port 18, respectively. A bridging portion 52 has at a central portion thereof a bulge 54 for engagement with depression a 56 formed at a lowermost, central portion of the well-like portion 17.

Further attention is now directed to Fig. 3 of the drawings in which the valve is shown in its position after applying pressurized fluids through inlet port 14 entailing flexion of the membrane 26 to disengage the rimmed annular edge 24, thus opening the fluid flow path between the first, inlet chamber 16 and

- 6 -

the second, outlet chamber 20, permitting fluid egress via the outlet port 18, as illustrated by arrows.

It will be noted that in the open position of the valve, as seen in Fig. 3, the membrane 26 bears against a central portion of the venting cover 28 while the 5 venting aperture 30 remains unblocked, thus ensuring that the space 32 remains at atmospheric pressure.

A person versed in the art will have no difficulty in realizing that the first and second ports and the first and second chambers may change their functions, respectively, i.e. the second port 18 may serve as an inlet port and the first inlet 10 port 14 may serve as an outlet port with the second chamber 20 serving as an inlet chamber and the first chamber 16 serving as an outlet chamber, respectively. It will further be appreciated by a skilled person that changing the cross-sectional area of the diaphragm 26 over the first chamber 16 or over the second chamber 20 will determine the differential pressure required for opening the 15 valve. Accordingly, the valve may be used as a uni-directional valve or as a Bi-directional valve with equal or different pressures required for opening the valve in either direction.

Attention is now directed to Figs. 4 and 5 of the drawings. In certain instances, it is required to prime a valve, e.g. to drain gases from a liquid supply 20 line or to rinse a supply line prior to administrating fluids. A non-limiting example where such priming means are required are valves used in medical liquid administration.

When it is required to momentarily prime the valve, the bottom portion 42 of well-like member 17 of the first chamber 16 is depressed upwards against the 25 resiliency of the resilient annular segment 42, whereby the top end 41 of priming member 40 encounters the membrane 26 and deforms it to the position seen in Fig. 3, i.e., opening the flow path 24 between the chambers, enabling flow through the valve.

However, when it is required to retain the valve 10 in its primed position, 30 i.e. when the pressure through the inlet port does not reach the predetermined

- 7 -

pressure threshold, then it is possible to open the valve and keep it in its open position by swinging the retention member 46 into the position seen in Figs. 4 and 5 in which the well-like member 17 of the first chamber 16 is depressed, thus entailing deformation of the membrane 26 into its open position. In order to ensure that the valve remains in its open position, bulge 54 snaps into depression 56 thus ensuring that the retention member 46 does not swing out of engagement with the bottom portion of the well-like member 17.

It will be appreciated to a person versed in the art that the design of the housing may be different than the specific design illustrated herein, e.g. the manner in which the venting cover and the bottom portion are engaged with the housing, location of the resilient portion, etc., *mutatis mutandis*.

CLAIMS:

1. A fluid valve (10) comprising a housing (12) fitted with a first port (14) being in flow communication with a first chamber (16), and a second port (18) being in fluid communication with a second chamber (20) coaxial with the first chamber (16); a fluid flow path (24) extending between the chambers (16;200; a resilient membrane (26) is tensioned over the fluid flow path (24) and over the first chamber (16) and the second chamber (20) so as to close the fluid flow path (24), said membrane (26) having one face thereof exposed to atmospheric pressure; the arrangement being such that when differential pressure across the membrane (26) exceeds a predetermined pressure threshold the membrane flexes and opens the fluid flow path (24) allowing fluid flow between the first chamber (16) and the second chamber (20).
2. A fluid valve according to Claim 1, wherein the valve (10) further comprises a priming member (40) for manually displacing the membrane (26) to disengage from the fluid flow path (24).
3. A fluid valve according to Claim 2, wherein the priming member is a stem (40) projecting from a wall portion (42) of the first chamber (16) whereby displacing the wall towards the membrane entails priming of the valve (10).
4. A fluid valve according to Claim 3, wherein the wall portion (42) is connected to other wall portions of the first chamber via a resilient, flexible zone (43).
5. A fluid valve according to Claim 3, wherein the priming member (40) is biased to disengage from the membrane (26).
6. A fluid valve according to Claim 4, wherein the flexible zone (43) is biased to resume its original shape.
7. A fluid valve according to Claim 2, further comprising a retention member (46) for retaining the priming member (40) in its displaced position thereby keeping the fluid flow path (24) open.

- 9 -

8. A fluid valve according to Claim 7, comprising a locking arrangement (54;56) for arresting the retention member (46) in a position in which the fluid path (24) is kept open.
9. A fluid valve according to Claim 7, wherein the first port (14) and the second port (18) co-axially extend from the housing (12) along an axis normal to the axis of the chambers, and where the retention member (46) is a bridge-like element having a retaining portion (54) for engaging the priming member, and two arms (48) each engaged with one of the first or second ports (14;18) and being rotatable about the ports' axis.
10. A fluid valve according to Claim 1, wherein the first chamber (16) is a well-like enclosure having a flexible deformable zone at a bottom wall and a top rimmed edge (22) forming the fluid flow path (24) and over which the membrane (26) is tensioned.
11. A fluid valve according to Claim 1, wherein the housing further comprises a venting cover (28) positioned in close proximity to the flexible membrane (26) whereby in its flexed state the membrane (26) bears against the venting cover (28), the venting cover (28) fitted with one or more venting apertures (30).
12. A fluid valve according to Claim 11, wherein the one or more apertures (30) are formed at peripheral portions of the venting cover (28).
- 20 13. A fluid valve according to Claim 1, wherein the second chamber (20) is in the shape of an annulus encircling the first chamber (16).

1/2

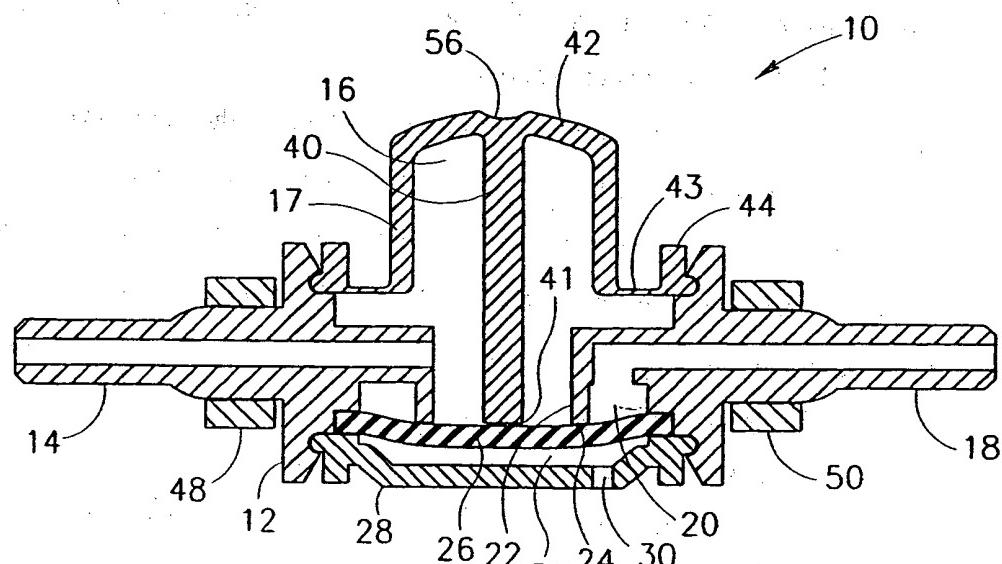


FIG. 1

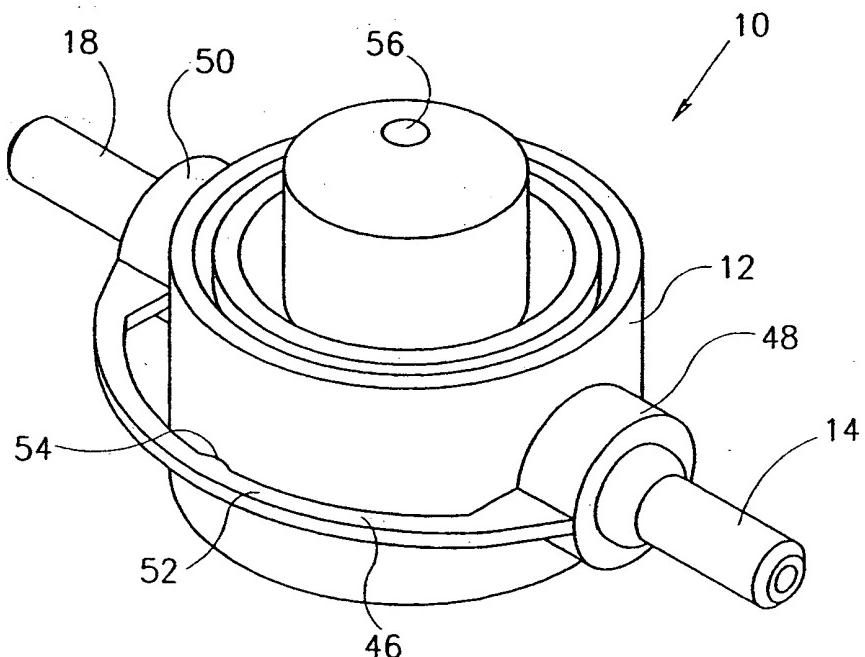


FIG. 2

2/2

FIG.3

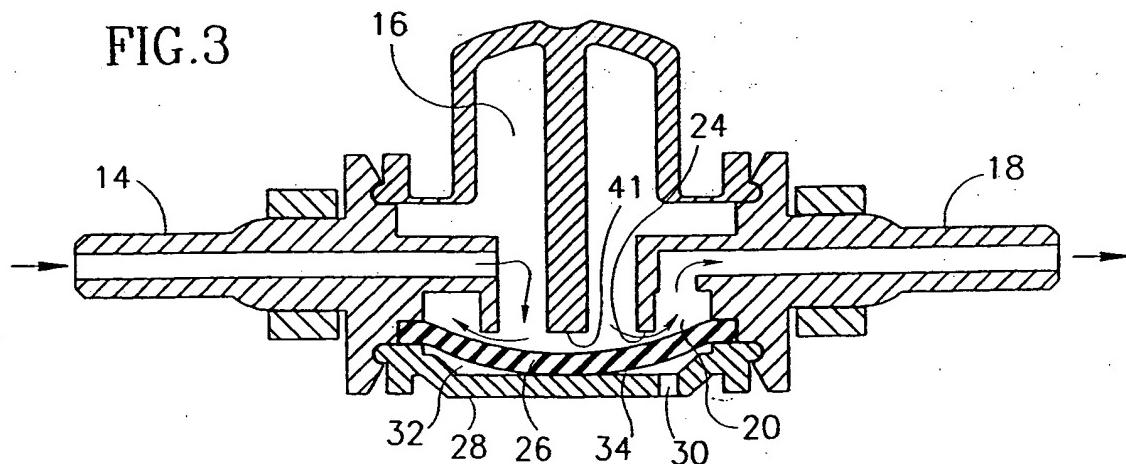


FIG.4

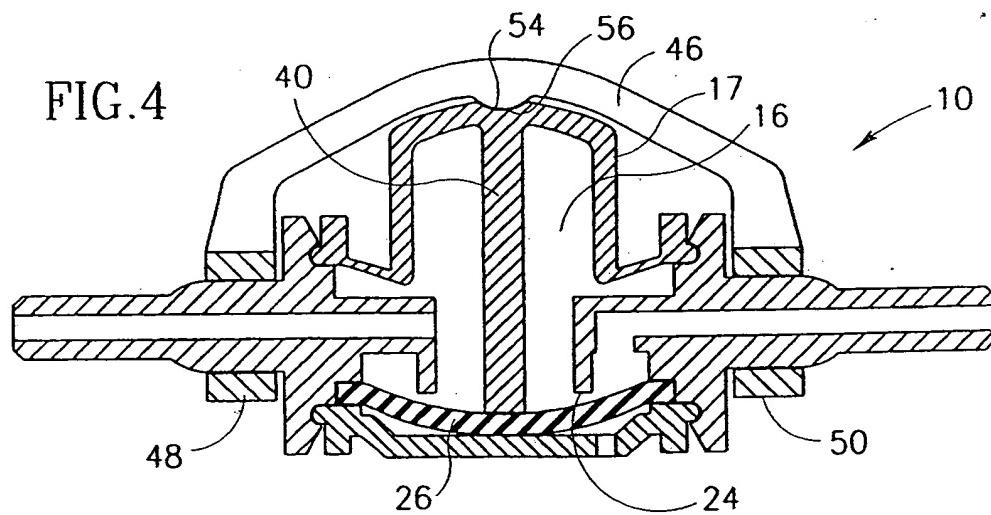
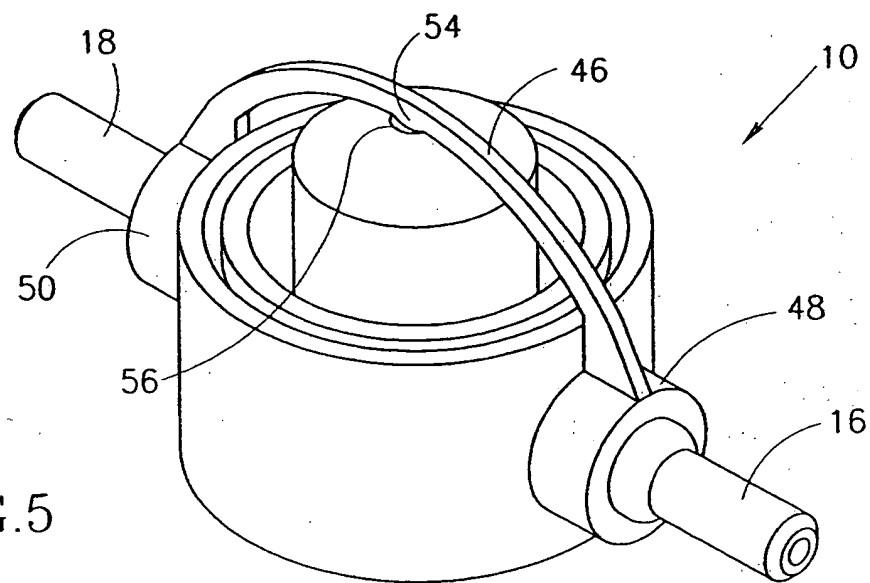


FIG.5



INTERNATIONAL SEARCH REPORT

Inte ional Application No
PCT/IL 99/00688

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61M5/168 A61M39/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 436 273 A (GRATZMULLER) 1 April 1969 (1969-04-01) the whole document	1,11-13
X	US 5 190 527 A (HAMILTON ET AL.) 2 March 1993 (1993-03-02) column 4, line 51 -column 5, line 53 column 6, line 50 -column 7, line 19 figures 4,5,8	1,2,7,8, 13
A	-----	3,4,6, 11,12
X	US 5 195 986 A (KAMEN) 23 March 1993 (1993-03-23) column 5, line 3 - line 42 figure 8	1,11
A	-----	9

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 February 2000	03/03/2000
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl. Fax: (+31-70) 340-3016	Authorized officer Schönleben, J

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IL 99/00688

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3436273 A	01-04-1969	BE 684366 A DE 1596123 A FR 1451530 A GB 1095083 A	03-01-1967 25-02-1971 01-12-1966
US 5190527 A	02-03-1993	US 5108373 A AU 628635 B AU 6199490 A CA 2024044 A,C GB 2237608 A,B JP 3121077 A	28-04-1992 17-09-1992 28-03-1991 26-03-1991 08-05-1991 23-05-1991
US 5195986 A	23-03-1993	US 4808161 A US 4826482 A US 4976162 A US 5088515 A US 4778451 A US 5364371 A US 5401342 A US 5533389 A US 5526844 A US 5575310 A US 5193990 A US 5178182 A US 5211201 A US 5349852 A US 5222946 A US 5353837 A US 5241985 A CA 1290211 A DE 3882966 A DE 3882966 T EP 0332690 A JP 2501198 T WO 8901795 A AT 175270 T CA 2049337 A DE 69032869 D DE 69032869 T EP 0471000 A JP 2952037 B JP 5502096 T WO 9013795 A AT 177955 T AU 672154 B AU 1229795 A AU 658825 B AU 7885891 A CA 2082057 A DE 69131043 D DE 69131043 T EP 0528947 A FI 925177 A IL 98152 A IL 104253 A IL 107308 A IL 107309 A MX 173229 B	28-02-1989 02-05-1989 11-12-1990 18-02-1992 18-10-1988 15-11-1994 28-03-1995 09-07-1996 18-06-1996 19-11-1996 16-03-1993 12-01-1993 18-05-1993 27-09-1994 29-06-1993 11-10-1994 07-09-1993 08-10-1991 09-09-1993 25-11-1993 20-09-1989 26-04-1990 09-03-1990 15-01-1999 02-11-1990 11-02-1999 02-06-1999 19-02-1992 20-09-1999 15-04-1993 15-11-1992 15-04-1999 19-09-1996 11-05-1995 04-05-1995 10-12-1991 16-11-1991 29-04-1999 18-11-1999 03-03-1993 13-11-1992 30-05-1994 30-03-1995 05-12-1996 04-08-1996 09-02-1994

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IL 99/00688

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5195986 A		WO 9117780 A	28-11-1991
		EP 0558607 A	08-09-1993
		JP 6502789 T	31-03-1994
		WO 9208503 A	29-05-1992

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER: _____**

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.

